

DEPARTMENT OF THE INTERIOR**Fish and Wildlife Service****50 CFR Part 17****Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Flattened Musk Turtle (*Sternotherus depressus*)****AGENCY:** Fish and Wildlife Service, Interior.**ACTION:** Final rule.

SUMMARY: The Service determines the flattened musk turtle (*Sternotherus depressus*) in the Black Warrior River system upstream from Bankhead Dam to be a threatened species. This turtle was historically restricted to Alabama's upper Black Warrior River system upstream from the fall line (the steep northeastern edge of the coastal plain). The Service considers the flattened musk turtle populations unaffected by hybridization with *Sternotherus minor peltifer* to presently be restricted to the Black Warrior River system upstream from Bankhead Dam. Portions of its habitat have been eliminated by impoundments and agricultural, residential, and industrial development within the Black Warrior basin. It is threatened by overcollecting, disease, and habitat degradation from siltation and water pollution. Activities and sources that have historically contributed, or may currently be contributing, to the siltation and pollution problems include agriculture, forestry, mining (conducted in violation of State or Federal laws and regulations), and industrial and residential sewage effluents. This determination implements the protection provided by the Endangered Species Act of 1973, as amended.

DATE: The effective date of this rule is June 11, 1987.**ADDRESS:** The complete file for this rule is available for inspection, by appointment, during normal business hours at the Endangered Species Field Office, U.S. Fish and Wildlife Service, Jackson Mall Office Center, Suite 316, 300 Woodrow Wilson Avenue, Jackson, Mississippi 39213.**FOR FURTHER INFORMATION CONTACT:** Mr. James Stewart at the above address (601/965-4900 or FTS 490-4900).**SUPPLEMENTARY INFORMATION:****Background**

The flattened musk turtle is a small aquatic turtle having a distinctly flattened carapace up to 119 millimeters (mm) or 4.7 inches (in) long, with keels virtually, if not altogether, lacking

(Mount 1981). The carapace is dark brown to orange with dark bordered seams and is slightly serrated behind (Ernst and Barbour 1972). The plastron is pink to yellowish. The head is greenish with a dark reticulum that often breaks up to form spots on the top of the snout (Mount 1981). Stripes on the top and sides of the neck, if present, are narrow. There are two barbels on the chin, all four feet are webbed, and males have thick, long, spine-tipped tails (Ernst and Barbour 1972).

According to Close (1982), male flattened musk turtles mature in four to six years at a body length of 60-65 mm (2.4-2.6 in), whereas females mature in six to eight years at a body length of 70-75 mm (2.8-3.0 in). Females normally deposit from one to two clutches of eggs each season with an average of three eggs per clutch.

All scientific treatments to date have considered the flattened musk turtle a morphologically distinct taxonomic entity that is found only in the upper Black Warrior River system of Alabama. It was originally described by Tinkle and Webb (1955) as *Sternotherus depressus*. Seidel and Lucchino (1981) considered *S. depressus* a full species, on the basis of morphometric and electrophoretic analysis. Ernst *et al.* (1987) considered *S. depressus* a distinct species on the basis of shell morphology. Other herpetologists, e.g. Wermuth and Mertens (1961), have treated it as a subspecies of *Sternotherus minor*.

Although the flattened musk turtle is found in a variety of streams and the headwaters of some impounded lakes, its optimum habitat appears to be free-flowing large creeks or small rivers having vegetated shallows about 2 feet deep alternating with pools 3.5-5 feet deep. These pools have a detectable current and an abundance of crevices and submerged rocks, overlapping flat rocks, or accumulations of boulders. Suitable conditions for this turtle include abundant molluscan fauna, low silt load and deposits, low nutrient content and bacterial count, moderate temperature, and minimal pollution (Estridge 1970, Mount 1981). Ernst *et al.* (1983) reported that *S. depressus* also inhabits stream stretches with sandy bottoms, alternating with suitable cover sites.

Herpetologists have been concerned about the status of the flattened musk turtle since it was first collected in 1952. Tinkle (1958), Estridge (1970), Iverson (1977b) and Seidel and Lucchino (1981) called attention to its limited distribution, noting preliminary evidence of gaps developing in its distribution at many places in the basin. They

interpreted those gaps as indications of a long-term population decline, and stated that *S. depressus* should be regarded as a threatened species. A symposium sponsored by the Alabama Department of Conservation and Natural Resources resulted in the 1976 publication (endorsed by the Department) of a list of Alabama's endangered and threatened species, which included the flattened musk turtle in the category of threatened. A recent update of the list of Alabama's endangered and threatened vertebrate species also included the flattened musk turtle (Mount 1986).

The Service included the flattened musk turtle in a notice of status review for 12 turtle species published in the June 6, 1977, *Federal Register* (42 FR 28903). Additional information was solicited to determine if this species should be listed under the Endangered Species Act. Information provided in response to that notice by herpetologists, including Drs. Robert Mount, James Dobie, Carl Ernst, John Iverson, R. Bruce Bury, Stephan Edwards, and George Pisani, suggested that the flattened musk turtle should be listed as threatened.

The Alabama Department of Conservation indicated in 1982, and again in 1985, its support of any Federal regulations that might be forthcoming in regard to the flattened musk turtle. The Reptiles and Amphibians Committee at the Alabama Non-Game Wildlife Conference on July 15 and 16, 1983, assigned the status of "Threatened and Declining" to this turtle. Dr. Karen Bjorndal and Dr. Don Moll of the Freshwater Chelonian Specialist Group of the International Union for Conservation of Nature/Survival Service Commission recommended listing the flattened musk turtle. It was included in the vertebrate notice of review published December 30, 1982 (47 FR 58454) and revised September 18, 1985 (50 FR 37958) as a category 1 species (those species for which the Service has information indicating listing is appropriate).

On December 1, 1983, the Environmental Defense Fund petitioned the Service to list the flattened musk turtle as a threatened species. A finding was published in the *Federal Register* on April 5, 1984 (49 FR 13558), that the petition contained substantial biological information to indicate that a listing action may be warranted. On July 18, 1985 (50 FR 29238), the Service announced the finding that the petitioned action was warranted, but precluded by other higher priority listing actions. The proposed rule published

November 1, 1985 (50 FR 45638), constituted the final required 12-month finding.

The flattened musk turtle has been the subject of three major studies since the 1977 notice of review was published. Dr. Robert H. Mount conducted the first status survey during 1981, under a contract with the Service. The Alabama Coal Association sponsored an additional study and survey work on the flattened musk turtle during 1983, under the project directorship of Dr. Carl A. Ernst. The report from the second study (Ernst *et al.* 1983) was released for the public record and for review by the Service in November 1984. It contained a smaller appended report compiled by personnel of Drummond Coal Company (Hubbard *et al.* 1983). The data the Service considered most relevant and the authors' conclusions from both studies were summarized in the proposed rule to list the flattened musk turtle. A third study targeted specifically at determining possible impacts of coal mining on flattened musk turtle survival and distribution was funded by the Office of Surface Mining, and conducted by the Fish and Wildlife Service during 1985 (Dodd *et al.* 1986). Results of the Dodd *et al.* (1986) study were not available at the time of publication of the proposed rule, but have been incorporated in the final rule.

Historically, the flattened musk turtle was found in the upper Black Warrior River system of Alabama upstream from the fall line (near Tuscaloosa), the break between the Piedmont Plateau and the coastal plain (Tinkle 1959, Estridge 1970, Mount 1976, Mount 1981, Ernst *et al.* 1983). Beginning about 1930, several dams were built on the Black Warrior River below and near the fall line. The impoundments that were created behind those dams extended from well below to well above the steep gradient that forms the fall line. It has been hypothesized that the newly created impoundments allowed the range of *S. minor peltifer* (previously limited to below the fall line) to be functionally connected for the first time to the River above the fall line, and to have contact with the range of *S. depressus* (Iverson 1977, Seidel and Lucchino 1981). This linkage eliminated a natural, environmental barrier to interbreeding between *S. depressus* and *S. minor peltifer* (Iverson 1977b). Bankhead Dam, which was constructed in 1915 and prior to the impoundments near the fall line, is further upstream and now constitutes the primary physical barrier between the ranges of *S. depressus* and *S. m. peltifer*. The Black Warrior River system below Bankhead Dam but above the fall line

now contains hybrid populations of *Sternotherus* turtles (Iverson 1977, Mount 1981). Resultant changes from impoundments and other habitat degradation have been suggested to favor *S. m. peltifer* over *S. depressus* (Seidel and Lucchino 1981). Only remnants or pockets of *S. depressus* unaffected by hybridization now occur there, if any such remnants do actually still exist. In this area where hybridization is occurring, it cannot be assumed that turtles that phenotypically appear to be good *S. depressus* have not been genetically affected by hybridization. Another interpretation is that the area from the fall line to Bankhead Dam is an area of natural intergradation between subspecies, with intergradation perhaps having been accelerated by habitat modification (Mount 1981).

As pointed out by the flattened musk turtle review panel (see Summary of Comments section), the specific identification of musk turtles inhabiting the section of river below Bankhead Dam to the fall line (Tuscaloosa County) has been a source of controversy, and remains so. Estridge (1970) identified one *S. depressus*, one *S. m. peltifer*-like turtle, and a presumed hybrid specimen from the North River, a large tributary of the Black Warrior River below Bankhead Dam. Ernst *et al.* (1983) relegated 18 *Sternotherus* that they collected from the North River to *S. depressus*. Ernst *et al.* (1987) reported that turtles in this area could not be differentiated from *S. depressus* on the basis of shell morphology but that head and neck patterns in many cases could be considered intermediate between *S. depressus* and *S. m. peltifer*. Iverson (1977) and Seidel and Lucchino (1981) suggested the presence of hybrids between *S. depressus* and *S. m. peltifer* in this area, and stated that stream impoundment and subsequent habitat alterations were the probable causes allowing hybridization. Mount (1986) also recognized turtles in this section of river as intermediates, and referred to them as intergrades (*S. m. peltifer* x *S. depressus*).

The data available to the Service at this time indicate that some *Sternotherus* in the Black Warrior River between Bankhead Dam and the fall line are phenotypic intermediates (primarily those in or near the main channel) and some (those in the North River and possibly other tributaries) closely resemble *S. depressus*. Turtles in the North River may represent a relict population of *S. depressus* remote from the main channel of the Black Warrior River and isolated from previous contact

with *S. m. peltifer*, but field work and genetic studies are required to verify this. However, there is no barrier to contact between these isolates and *S. m. peltifer* and interbreeding would be expected to occur eventually if it has not already occurred. In the main channel and smaller "backwater" tributaries of the Black Warrior River between the fall line and Bankhead Dam, it appears that gene exchange, possibly substantial, has occurred between *S. m. peltifer* and *S. depressus*.

The Service has excluded the area between Bankhead Dam and the fall line from the effects of this final rule. The available evidence indicates a likelihood that few *S. depressus* inhabit this portion of the Black Warrior River system and that the *S. depressus* remaining in this area are subject to hybridization with *S. minor peltifer*. Because the environmental conditions below Bankhead Dam now appear to favor *S. minor peltifer*, that taxon will likely continue to extend its range there, further hybridizing with *S. depressus* wherever the two make contact during the next several decades. Individuals of hybrid origin are not covered under the Endangered Species Act (Department of Interior Solicitor's opinion, 1983). Populations of *S. depressus* unaffected by hybridization are presently known or believed to exist only upstream from Bankhead Dam in Blount, Cullman, Etowah, Jefferson, Lawrence, Marshall, Tuscaloosa, Walker, and Winston Counties, and therefore, the geographical scope of the present listing has been limited to this area. Any distribution in Fayette County is considered unlikely although not impossible; the widths and gradients of upper basin streams (entering the Black Warrior above Bankhead Dam) in east Fayette County are not in the range that Guthrie (1986) considered likely as habitat, and all musk turtles reported from farther west in the county (streams entering the Black Warrior below Bankhead Dam) are considered to show evidence of hybridization (Mount 1981, Estridge 1970).

The Service stresses that the evidence of present and future hybridization of the musk turtle population between Bankhead Dam and the fall line affects only the geographical scope of the listing and has no effect on the decision to list *S. depressus* as threatened. If there had been no evidence of hybridization of *S. depressus* below Bankhead Dam the Service would have proposed to list the species in this area as well. The primary reason for this is that the same degraded habitat conditions that form part of the basis for listing above Bankhead Dam

also exist below the Dam. Even if the entire historical range from the fall line upstream is considered the species' range and current numbers are extremely limited and the same threats apply.

The flattened musk turtle has been the subject of three recent studies that provide data on the impacts of habitat degradation (Mount 1981, Ernst *et al.* 1983, Dodd *et al.* 1986). In all three studies, the data indicate a strong correlation between heavy accumulations of silt and the absence or rarity of flattened musk turtles captured or observed, especially juveniles. Ernst *et al.* (1983) provided evidence that this effect was most strongly correlated with clay silt accumulations, but reported occurrence of *S. depressus* over a bottom of deep sand at two localities on one stream. Dodd *et al.* (1986) concluded after an intensive study that siltation appears to have seriously impacted the flattened musk turtle. None of the available studies presented conclusive evidence about the source of the clay siltation, nor its extent (fraction of the range that is unsuitable due to clay siltation).

While no single agricultural, industrial, or other activity is considered to be the sole cause of clay siltation, the combined effects of all activities and sources that have historically, and may currently be contributing to the siltation problem have significantly impacted the Black Warrior River Basin. The entire upper Basin is underlain by the Black Warrior and Plateau Coal Fields, and mining as well as forestry and agriculture are common land uses throughout the Basin. Before implementation of stricter regulations to limit the amount of silt entering the basin, about 69 percent of the annual sediment yield was attributed to accelerated erosion from such sources (USDA 1980). Annual erosion in 1975 was estimated at 5.5 million tons from cropland and pastureland (sheet and rill); 4.1 million tons from commercial forest land; 7.9 million tons from gulleys, roadsides, and streambanks; and 9.1 million tons from mined lands (USDA 1980).

While historically the Black Warrior River Basin has been significantly impacted by siltation, enforcement of the new regulations may have reduced both the amount and rate of current and future sedimentation. Many of the involved agencies are making progress to reduce siltation, but projections based on the newer regulations are not available. Stream recovery and any resulting improvement in the turtle's status are expected to be slow

processes, and it may be some time before it can be determined if, and to what extent, these are occurring. Remaining habitat of the flattened musk turtle in the Black Warrior basin upstream from Bankhead Dam has been adversely affected by siltation. Past siltation continues to affect the habitat, and although efforts have been made to reduce the rate, siltation continues to be a problem for the foreseeable future. Likely adverse impacts include: (1) The extirpation or reduction of populations of mollusks and other invertebrates on which the turtle feeds, (2) physical alteration of the rocky habitats where the turtle seeks food and cover, and (3) development of a substrate in which chemicals that may be toxic to the turtle or its food sources tend to accumulate and persist.

The composition of size classes within populations is one indicator of their normal reproduction and longevity. Demonstrated lack of juveniles signifies reduced rates or absence of recruitment, and consequently low population viability. Of all flattened musk turtles collected before 1970, 55 percent were juveniles (Dodd *et al.* 1986), including a large fraction of the original type series (Tinkle and Webb 1955). Mount (1981) found that 14 percent (14 out of 101) and Ernst *et al.* (1983) found that 15 percent (89 out of 577) of the turtles they collected had a carapace length shorter than 70 mm (considered juveniles). Actual changes in the overall size distribution or simply collecting bias (collection by wading yields a preponderance of juveniles, collection by trapping yields a preponderance of adults) have been suggested as contrasting interpretations of these differences. In fact, both explanations may be true; they are not mutually contradictory. Dodd *et al.* (1986) found a statistically significant absence of juveniles at mine affected sites when compared with populations at mine unaffected sites, and also noted that the populations sampled at mine affected sites were skewed toward very large adult sizes. Significant absences of juveniles in comparison to the average size distribution at all sites sampled can be found in Appendix A of Ernst *et al.* (1983). From two sites where apparently adequate wading efforts to obtain juveniles were reported, 29 and 20 individuals with carapace length greater than 70 mm were taken without any individuals smaller. The average composition of turtles larger than 70 mm at all sites was 84.6 percent, and the probabilities that the two sites mentioned were subsamples of that average composition drawn at random

were about 0.0078 and 0.0351, respectively, both significant at the 95 percent level of confidence. These data suggest that reductions in the proportion of juveniles present at these sites were not a result of random variation. Remaining uncertainties involve the possible causes of such reductions and the magnitude of their effects on survival of the species.

Within its geographic range, the flattened musk turtle occurs only in a restricted portion of the apparently suitable habitat. In addition, local distribution appears fragmented. Two major distributional surveys found flattened musk turtles at fewer than one-half of the combined (approximately 125) sites sampled. Mount's estimate of the number of stream miles where this turtle has probably been extirpated amounts to 27 percent of its range. Ernst caught no *S. depressus* at 47 percent of the locations that he sampled. Based on Ernst's design objectives of sampling known or potential range, it is assumed that he did not sample the area Mount included as extirpated. An evaluation of USGS water quality records and Mount's collections, field observations, and habitat characterizations, suggests that only 15 percent of the Black Warrior system (142 out of 947 stream miles, including impoundments) supports healthy, viable flattened musk turtle populations. An evaluation of Ernst's field data, assuming (1) that population vigor is characterized by the numbers of individuals trapped and trapping success rates, an array of sizes among the specimens collected at individual locations, and evidence of some reproduction having occurred in more recent years, and (2) a statistically valid distribution of sample sites throughout the basin (as reported), suggests that only 10 to 20 percent of the Black Warrior system supports healthy, viable flattened musk turtle populations.

Summary of Comments and Recommendations

In the November 1, 1985, proposed rule (50 FR 45638) and associated notifications, all interested parties were requested to submit factual reports or information that might contribute to the Service's effort in evaluating the turtle's status and determining if Endangered Species Act protection is justified. Appropriate State agencies, county governments, Federal agencies, scientific organizations, and other interested parties were contacted and requested to comment. Newspaper notices were published in the *Birmingham News* on November 17, 1985, the *Cullman Times* on November

17, 1985, the *Jasper Mountain Eagle* on November 15, 1985, and the *Oneonta Southern Democrat* on November 20, 1985, which invited general public comment. A public hearing was requested and held in Birmingham, Alabama, on February 6, 1986. The comment period was reopened until February 16, 1986, to accommodate the public hearing and then again extended to March 18, 1986, to allow for review and comment on the flattened musk turtle study by Dodd *et al.* (1986), as was requested by some commenters. Comments, either written or presented orally at the public hearing, were received from 29 parties; some parties provided more than one comment.

Seventeen parties supported the proposal; these included the Environmental Defense Fund, which petitioned the Service to list the species, other conservation organizations, professional societies, college professors, and private individuals. Five parties provided comments and/or information but did not indicate either support of or opposition to the proposal. Seven parties expressed opposition to the proposal including the Alabama Congressional delegation, trade organizations, Chambers of Commerce, and private individuals. Many parties provided data further substantiating or clarifying the threats to the species. This information has been incorporated into the final rule where appropriate.

On October 31, 1986, the Service published a notice (51 FR 39758) extending the one-year deadline for six months until May 1, 1987. Comments submitted on the proposed rule during the previous comment periods indicated the existence of disagreements concerning the interpretation of biological data on the turtle. When such a scientific disagreement exists the 1-year period within which the Service must ordinarily take final action on a proposal to list a species may be extended for not more than 6 months in accordance with section 4(b)(6)(B)(i) of the Act. The Service established a panel of herpetologists to review all the available data and reopened the comment period. The panel's report was made available to the Service on February 2, 1987. The report was made available for review by the public and the comment period closed 30 days after the availability of the report was announced in the *Federal Register* (52 FR 5068; February 18, 1987) on March 20, 1987.

Seven additional comments were received in response to the panel report and during the reopened comment period. Five comments, from Dr. Robert

Mount, the Environmental Defense Fund, a private individual, the Alabama Conservancy, and the Alabama Wildlife Federation supported the panel's findings and/or requested that the final rule be expedited. Two comments from the Alabama Coal Association and a private individual stated disagreements with the panel's conclusions and/or requested that the proposal be withdrawn. One commenter submitted a 1987 paper by Ernst *et al.* with his comments, which has been discussed in the Background section and below under Issue 17.

All written comments and oral statements obtained during the public hearing and all comment periods are covered in the following discussion. Comments of similar content are grouped in a number of general issues. These issues and the Service's response to each, are discussed below.

Issue 1: Endangered status was recommended as opposed to threatened. **Response—**The Service believes the category of threatened more accurately describes the biological status of the species. It does not appear to face imminent extinction now, but is likely to become an endangered species in the foreseeable future if the past trends continue.

Issue 2: The data sets of Mount (1981), Ernst *et al.* (1983), and Dodd *et al.* (1986) were compared, debated, and questioned by some commenters. These commenters also questioned the Service's interpretation of these data sets and the Service's conclusion that the flattened musk turtle should be listed as threatened. **Response—**The Service utilizes all available information when assessing the status of a species; it does not necessarily accept without question all the data presented or concur with the conclusions reached by all the authors and documents cited in the proposal. Specific points upon which commenters disagreed with the Service's interpretations or conclusions are addressed in the issues below. It is important to point out that the data sets and findings of these three major studies were much more similar than dissimilar. A primary finding in all major studies was the absence or extreme rarity of flattened musk turtles at all sites showing significant accumulations of clay silt (sandy silt was not correlated with this effect in any study). The general attributes of suitable habitat were similarly described (with Ernst *et al.*, 1983, noting the occurrence over deep sand substrate as a new observation, even in Sipsey Fork where Mount and Dodd also described sandy habitat). More than 45 percent of the

sites in the Mount and Ernst surveys yielded no *S. depressus*. Dodd found eight *S. depressus* in more than 2,700 trap hours at two sites where neither Mount nor Ernst surveys had taken any, but added none in 2,755 trap hours where the Ernst survey had trapped two in 671 trap hours. These results suggest that both Mount and Ernst reports gave reasonable indications of *S. depressus* absence or extreme rarity, and that these change slightly over time, or cannot be distinguished from one another, or both. Several additional sites in all three studies had indications of reduced or limited population numbers coupled with the absence or extreme rarity of younger size classes. Ernst *et al.* minimized discussion about these, generalizing only about the size class ratios among the total number of *S. depressus* collected throughout. Those were dominated by the more balanced size distributions at the four most productive sites, which yielded among them 56 percent of the *S. depressus* captured. All of the contributing studies reported circumstantial evidence of heavy commercial taking of *S. depressus*, while the Ernst survey results also implicated the selective elimination of juveniles.

Issue 3: One comment suggested that historic habitat should be defined solely on the basis of positive findings by Mount (1981) and Ernst *et al.* (1983). **Response—**It is not clear whether the comment referred to the historic range of the species or to the fraction of former habitat presently occupied. Ernst *et al.* (1983) stated "Its geographical range has been determined to be permanent streams of the Black Warrior River system above the Fall Line (Iverson 1977). Thus its entire range lies within Alabama, and more importantly, within the Warrior Coal Basin." This agrees with the Service's concept of the geographic historic range of the species. In regard to the historic habitat, present distribution of this turtle is scattered over most of the larger streams of the basin at variable (but mostly very low) densities, and has been found at moderate to high density in very few spots. The Service sees little reason to doubt that: (a) *S. depressus* was able to utilize intervening and adjacent stretches of those streams wherever slope, substrate, depth and volume of water, and known kinds of food organisms were generally comparable to those in areas where it is now locally concentrated, (b) much, if not most of the length of the larger streams in the basin were at one time suitable as habitat in respect to those factors, (c) very significant losses of that area have

occurred and are continuing to occur as impoundment, siltation, and organic and chemical pollution have modified one or more of the stated factors. The exact percentage of probable historic habitat now occupied cannot be known, and the available estimates are not precise, but they are credible. The estimate of 15 percent that the Service used in the proposed rule, its derivation, and the estimates obtained by analyzing survey data of Mount (1981) and Ernst *et al.* (1983) (17 and from 10 to 20 percent respectively) were discussed above in the "Background" section.

Issue 4: The possible presence of the flattened musk turtle in the Coosa, Cahaba, Tombigbee, and other river drainages was suggested. Response—Although herpetologists have examined the Coosa, Cahaba and Tombigbee drainages (Dodd, pers. comm. 1986), no *S. depressus* collections have ever been reported from these areas and the Service had no reason to expect the flattened musk turtle to occur in these streams. Certain similarities of appearance between musk turtles in these and the Black Warrior drainage mentioned by Estridge (1970) appear to be attributable to convergence (Mount 1981).

Issue 5: Field studies have not established good population estimates for this turtle. Response—This is true, and has been discussed in all the field reports available. Dodd *et al.* (1986) stated that sufficient numbers of turtles have not been collected to estimate population sizes reliably anywhere except in Sipsey Fork. Exact population estimates are not necessary to recognize overall declining trends. The relative success or failure of a population to reproduce is a more significant indicator of capacity to survive than a species' numbers at a given time, especially when dealing with long-lived organisms such as turtles. A lack of younger age classes at a number of sites is discussed under "Background."

Issue 6: The extent and method of collecting affects the number, size, and age of specimens collected and there are problems inherent in comparing data from different years and collectors. Response—The Service concurs that collection methods and the frequency, spacing, etc. of collections affect the results obtained, and that this should always be borne in mind when assessing collection results. The Mount survey could compare its results only to previous collectors who used a variety of methods, some unspecified. Ernst *et al.* (1983) noted that "Mount (1981) inferred from his data that *depressus* populations today may have

substantially fewer juveniles than those prior to 1970," and Mount's inference may be true. Ernst *et al.* noted further that "The lumping of the pre-1970 data . . . may be invalid for comparison . . ." Both statements by Ernst *et al.* (1983) are correct, and both also are appropriately indefinite. Consistency in the primary collecting methods adopted (night trapping using standard bait, supplemented with daytime wading) made the results of Mount (1981), Ernst *et al.* (1983), and Dodd *et al.* (1986), however, very comparable. As discussed in Issue 7, the results of these three studies were also more consistent than some commenters indicated.

Issue 7: Dr. Ernst commented that his survey (1) took more turtles, and (2) at a significantly greater percentage of its sites than the Mount survey, demonstrating that the turtles were more numerous than previously claimed. Response—The data of these two surveys do not support this claim. First, the Ernst survey invested approximately five times the amount of effort to obtain turtles as the Mount survey did, and obtained almost exactly five times as many turtles, having a very similar profile of overall size distribution. As pointed out in the discussion of Ernst *et al.* (1983) and in the proposed rule, there was no significant difference in the average number of turtles caught per trap hour or per trap night in either study (0.4072 versus 0.4044 per trap night, a rate difference that would yield 3.5 more turtles over the 1250 trap nights of the Ernst survey). Second, the Mount survey examined and described 68 localities, but it trapped for turtles at only 40, securing turtles at 21 (53 percent). The Ernst survey secured turtles at 36 out of 68 sites trapped (likewise 53 percent). There were few differences also in the fraction of sites with fine silt or other habitat problems, although the subjective formats used in both studies to describe these make exact comparisons difficult.

Issue 8: Correlations between molluscan availability and the presence and/or abundance of flattened musk turtles were questioned. Response—The consumption of molluscs by flattened musk turtles was demonstrated by Marion *et al.* (1986). They found 70 percent of the fecal content to be snails and 12 percent bivalve mollusks. While there are limitations to dietary analysis by fecal content, the importance of mollusks, especially snails, is evident. Ability of the flattened musk turtle to subsist on other foods has not been demonstrated. The known food organisms, usually including snails, were reported by Ernst *et al.* (1983) as

present in some density at all localities where reasonable densities of flattened musk turtles were found, and were not seen at several sites where these turtles were not found. The comment elaborates that unspecified numbers of such turtles "have been found" without these food organisms and "vice versa." The implied existence of areas with known food availability that lack turtles actually argues against the primary point of this comment, but neither alternative was documented as anything more than an isolated observation having limited significance. This commenter readily documented certain other claims for which documentation was available.

Issue 9: Desirable sedimentation yields for fisheries are of no use. Response—Sediment yields for fisheries were used to illustrate general water quality levels. Flattened musk turtles (Marion *et al.* 1986) and fish both feed upon mollusks, which are adversely affected by degraded water quality. Typically, many mollusks are even more vulnerable than fisheries to water quality problems. Dr. Ernst commented that he had observed mollusks to be present in very silted areas. The Service would expect this to represent a rare situation.

Issue 10: The proposal alleges low pH as a problem in the Black Warrior River. Response—The proposal did not cite low pH as a problem, and the Service does not consider it to be a problem. The primary reference to acid mine drainage was a correlation of negative trap results with specific conductance values greater than 175 micromhos.

Issue 11: The Service overlooked the findings of Ernst *et al.* (1983) in favor of other studies that had more pessimistic conclusions. Response—On the contrary, the data of the Ernst survey went beyond that of the smaller Mount survey, and have been very valuable to the Service in reaching its present conclusions. The Ernst survey sampled more possible habitat types, e.g. more sites in reservoirs and smaller streams, studied more habitat variables, and reported more wading effort in search of juvenile turtles. Especially as they contrast to optimistic projections that Dr. Ernst had filed with the Service in critique of Dr. Mount's findings and methods before his own survey began, the negative evidence and findings reported in the Ernst survey achieve credibility even stronger than many of the opinions or conclusions stated by Ernst *et al.* (1983) or by any of the other contributors. At the same time, some very good collections obtained at the three best sites in the Ernst survey

served to validate the standard sampling methods used in all three major studies. Only in the larger samples based on greater collection effort in the Ernst and Dodd surveys could the reduced numbers or absence of juveniles at some localities be recognized as statistically significant deviations from average values or values found at other localities.

Issue 12: Dr. Ernst claimed that the proposal gave an erroneous impression that Ernst *et al.* (1983) indicated the entire Black Warrior watershed to be unfit. Response—The Service did not intend to give that impression, and has revised several aspects of the final rule to avoid that implication.

Issue 13: The statement in the proposal that the Ernst report found habitat that was heavily degraded is a gross mischaracterization. Response—The observance of habitat degradation in the Ernst report can be found on pages 3, 114, 115, 117, 118, 119, 120, 121, 122, and 129. For example, with reference to one collection site, the Ernst report stated: "This site is in the upper reaches of a stream which has received extensive degradation from surface mining and agriculture along much of its length. Above this influence a moderate to high density *depressus* population still exists, and serves to illustrate quite dramatically the detrimental environmental impact which can occur as a result of these activities."

Issue 14: Could the flattened musk turtle be bred or transplanted elsewhere? Response—Such possibilities will be explored during the recovery process with regard to reintroduction of the turtle to parts of its historical range from which it has been extirpated.

Issue 15: The Service's procedural handling of this listing action was questioned. Commenters felt the Service had decided on a final course of action prior to the closing of the comment period. Response—Written comments and those presented at the public hearing are carefully analyzed during the Service's administrative decision making process. Neither the Service nor the Department reaches any decision on any listing prior to the closure of the comment period or prior to a complete analysis of all information received. The Service objectively and carefully analyzed the biological information on the flattened musk turtle and the comments received prior to making the decision to list.

Issue 16: Are definitive data available regarding the disease that has been noted by researchers to affect this turtle? Response—The disease and its causative agent have not been identified

to date, although the Service is pursuing further information (see factor C in the "Summary of Factors Affecting the Species" section). The question was also raised as to whether basking in the flattened musk turtle is normal (as suggested by one commenter) or whether it is abnormal behavior associated with diseased individuals. The Service does not have a conclusive answer to this question. If basking behavior is independent of disease, as one comment suggests, then the high incidence of disease observed among basking individuals (Mount 1981, Dodd 1986) may indicate a serious disease problem in the population as a whole. One comment suggested that disease is more prevalent in high density populations such as Sipsey Fork. No data exists to suggest that population levels should be considered abnormally high at the Sipsey Fork location. Other studies of kinosternid turtles have indicated much higher population levels than exist at Sipsey Fork yet serious disease has never been found in those populations.

Issue 17: Further explanation of the existence of intergrades between the flattened musk turtle (*Sternotherus depressus*) and the stripe-neck musk turtle (*Sternotherus minor peltifer*) was requested. One commenter submitted a manuscript by Ernst *et al.* (1987), which addressed the relationship of *S. depressus* and intergrades below Bankhead Dam. The Service's proceeding with a proposal prior to resolution of the proper taxonomic treatment of the intergrades was questioned. Response—Turtles with characteristics (degree of flatness of the carapace, neck and chin coloration and patterns, etc.) intermediate between *S. depressus* and *S. m. peltifer* have been collected. Intergradation (hybridization) of *S. depressus* and *S. m. peltifer* has been noted as occurring below Bankhead Dam (Mount 1981). The Service did not examine the specific turtles collected from Davis Creek by Drummond Coal Company. Davis Creek is below Bankhead Dam and is within that portion of the Black Warrior watershed where hybridization has occurred (see discussion in the "Background" section also). Following hybridization, the physical appearance of the turtles in the Davis Creek population could range from typical *S. depressus* to typical *S. minor peltifer*. The Davis Creek population is likely to show less pronounced *S. depressus* characteristics as interbreeding with *S. m. peltifer* continues. Whether the turtles in the Drummond sample had appeared to be all *S. depressus*, all *S. minor peltifer*, all hybrids, or any

combination thereof, would have had no direct bearing on whether to or not to list (see discussion under Background section also). Ernst *et al.* (1987) considered the "presumed intergradient populations in west central Alabama" (Black Warrior River tributaries between Tuscaloosa and Bankhead Dam) referable to *S. depressus* on the basis of shell morphology comparisons among turtles of the *S. minor* complex. Determining the extent of hybridization (intergradation) in populations below Bankhead Dam would require extensive study and the comparison of characteristics other than shell morphology. Detailed biochemical and genetic studies, for example, would be necessary to document the precise extent of hybridization and to infer the reproductive fate of hybrid individuals. Whether individuals from intergrade populations are closer to *S. depressus* or *S. m. peltifer* with regard to shell characteristics does not negate other evidence that gene flow has occurred between *S. depressus* and *S. m. peltifer* in the area below Bankhead Dam. Hybridization has been occurring for some time and will continue to occur possibly eliminating all pure *S. depressus* from this area over time, if this has not already occurred. The Service will treat the entire population downstream from Bankhead Dam as hybrids for purposes of listing, recovery, and law enforcement. Hybrids are not considered (Department of Interior Solicitor's opinion, 1983) to be protected by the Endangered Species Act. The existence of intergrades and hybrids in nature is common; the Act does not provide for withholding the proper classification of species in need of protection under the Endangered Species Act because of the occurrence in some locations of hybrids or intergrades.

Issue 18: OSM provided as one of its comments a document by W. Guthrie (1986), which examined the correlation between slope, silt, and the occurrence of flattened musk turtles, and proposed further investigations of this. The document also claimed: (1) That the lower turtle/trap ratio reported by Dodd *et al.* (1986) may have been due to trap saturation, and (2) the population decline in Sipsey Fork documented by Dodd *et al.* (1986) is the result of commercial turtle collecting. Response—The Service doubts that the relationships are quite as uncomplicated as suggested by Guthrie, but considers this a reasonable approach for further research. In respect to the claims: (1) Mount used an average of one trap for each 50 yards; Ernst *et al.* did not state

the inter-trap distance but had trap yield rates virtually identical to those of Mount; Dodd *et al.* spaced traps an average of 54.5 yards apart. (2) The population decline at Sipsey Fork could have been the result of collecting, or could have been disease-related; the Service does not have conclusive information on this point. Other information in Cuthrie's document will also be utilized by the Service as recovery plans are developed.

Issue 19: Several commenters said that the proposed rule presented mining as the worst or primary culprit contributing to sedimentation and other water quality problems. Commenters pointed out that the Soil Conservation Service (SCS) 1980 data reported in the proposal were based on projections developed prior to the passage of the most recent laws and regulations. Response—The proposal did not state that mining was presently the primary contributor to sedimentation and other water quality problems, but instead cited forestry, agriculture, industrial and residential sewage effluents, and mining as activities and sources of silt and pollutants both historically and presently. The Service does not have current data illustrating which of these activities presently contributes the most sediment and, since most parts of this watershed have all these activities present, this point would be difficult to determine. Projections based on the newer mining regulations are not available. The proposed rule did include more information on mining activities than on the other activities, including the SCS projections, but this was simply a reflection of the data available to the Service, and was not intended to single out or serve as any indictment of the mining industry. The proposal did not place blame, but rather attempted to demonstrate that siltation of fine particle size from any and all sources contributes to the degradation of flattened musk turtle habitat. The Service regrets any misinterpretations that have occurred. The Service issued a no-jeopardy Section 7 biological opinion to OSM on the State of Alabama's mining program prior to proposing to list the flattened musk turtle. The Service's Jackson Field Station has and will continue to work with OSM, the Bureau of Land Management, and the State of Alabama to insure that their programs adequately address the needs of the flattened musk turtle. It is anticipated that this can be accomplished through a cooperative effort, and will not require changes in OSM's or the State of Alabama's present mining regulations or the original no-jeopardy opinion.

Issue 20: Several commenters provided extensive comments and data illustrating the differences between active mines in compliance with current laws and regulations versus abandoned mines and the amount of sedimentation contributed by each. These commenters felt the proposal should have made this distinction. Some commenters felt that even historical, pre-regulation and abandoned mines did not nor do not impact the flattened musk turtle. Response—The proposal did not state that active, compliant mining operations are a major contributor to the decline of the turtle, nor that current and future mining would be appreciably affected, much less eliminated. To eliminate compliant mining operations would, in fact, serve no useful purpose or, by itself, appreciably improve the status of the flattened musk turtle. There is no evidence that current compliant mining operations are a major factor in the decline of the turtle. The Bureau of Land Management (BLM), the Office of Surface Mining (OSM), and the Alabama Department of Environmental Management (ADEM) stated that existing mining permit limitations will provide sufficient protection of water quality, assuming operator compliance. The Service has issued a section 7 opinion on Alabama's program (see discussion above) and has also modified Factor "A" under "Summary of Factors Affecting the Species" to reflect the protection provided by the existing regulations. Welfare of the flattened musk turtle requires that the criteria established by OSM and ADEM be adhered to closely in practice. The Service will work closely with these and other agencies to approach or achieve 100 percent compliance as part of the recovery process. The Service has some reservations about the extent to which limitations on effluents are reduced as rainfall increases, and about whether monitoring of effluents is continued during periods of heavy rainfall, and will address this issue and any others that arise with the involved agencies during the recovery process. The Service feels that sedimentation from pre-regulation mining and abandoned mines is certainly a more serious problem than any sedimentation from active, presently complying mines that may now occur. The Service will work with OSM, ADEM, and the Abandoned Mine Lands Programs to encourage the reclamation of abandoned mines during the recovery process. Two abandoned mines located near flattened musk turtle habitat have already been targeted by OSM for clean-up since publication of the proposed rule.

Issue 21: Commenters felt that an assumption had been made that the Federal and State agencies responsible for monitoring and permitting active mines were not enforcing or would not enforce the existing laws and regulations. Response—The Service expects that all mining and pollution laws will be enforced by OSM, the Environmental Protection Agency (EPA) and their Alabama counterparts, Alabama Surface Mining Commission (ASMC) and ADEM, and it recognizes the advances that have been made in enforcement of such laws. For example, the OSM and ASMC programs have made great progress in developing environmentally sound regulations for mining, and report having accomplished a 95 percent compliance rate for active mines in the Black Warrior System. Some reduction of siltation (from all sources) and other effluents seems to be occurring with adoption of strict standards by Federal and State agencies. However, a corresponding improvement is not yet evident in the populations of the flattened musk turtle. While the Service certainly believes that OSM, EPA, and the corresponding Alabama agencies are making progress in bringing about improvements in the water quality of the streams, the Service also recognizes that there are other contributors of sediments, that stream recovery is a slow process, and that water quality is one of the important habitat factors in the species' status. Factor D in the "Summary of Factors" section of the proposal did not address the various laws and regulations governing mining because this section deals only with laws specifically addressing the species that is the subject of the proposed rule.

Issue 22: Dire economic consequences, such as the stopping of all mining in the Black Warrior Basin, were predicted and feared if the turtle were to be listed. Response—Section 4 of the Endangered Species Act prohibits the Service from considering economic impacts in determining whether to list a species. The Service does not, however, foresee the socioeconomic impacts suggested nor envision any circumstances under which they might occur. Based on current data, there is no reason to believe that any restrictions on current or future mining activities, conducted in accordance with current OSM and State regulations, will arise as a result of the listing. There is certainly no reason for a cloud of uncertainty to exist over development within the entire Black Warrior Basin, as commenters suggested. Any Federal agency funding, authorizing, or carrying out projects that

may have an effect on the flattened musk turtle or any other listed species or its habitat can initiate a Section 7 consultation immediately. The Service will work closely and earnestly with the mining, forestry, agricultural, and other interests in the Black Warrior Basin to accommodate their projects while ensuring the continued survival of the flattened musk turtle.

At the public hearing, Dr. Ernst posed the question "If the proposal is approved, will agriculture as well as surface mining be forced to cease along waterways containing *depressus* since it is the major contributor of silt?" Neither surface mining nor agriculture will be forced to cease in the Black Warrior Basin, and effects on both are expected to be minimal. Questions such as this and other dire predictions have generated unfounded and unwarranted fear of the listing. The Service will work with the local communities to dispel these erroneous impressions during the recovery process.

Issue 23: One commenter noted the inconsistency of the coal industry stating that the industry is not contributing to the deterioration of streams in the upper Black Warrior River Basin and simultaneously claiming that listing of the turtle could force the coal industry out of existence. **Response—**The Service agrees that if the coal industry is not negatively affecting the turtle, then listing of the turtle should have no effect on the industry.

Issue 24: Commenters questioned why critical habitat was not proposed. Some suggested that this cast doubt on what the species' true range is and that the Service had chosen not to designate critical habitat in order to avoid conducting an economic analysis. **Response—**Critical habitat was not proposed for the flattened musk turtle due to the severity of the problems with collectors. Section 4 of the Endangered Species Act (ESA) requires designation of critical habitat concurrent with listing to the maximum extent prudent and determinable. The overcollection pressures facing the flattened musk turtle make it imprudent to designate critical habitat (see "Critical Habitat" section). Economic analyses as required by the ESA address only the impact of critical habitat designations, and do not address the listing itself.

Issue 25: Commenters requested that the Service prepare economic analyses under Executive Order 12291 and the Regulatory Flexibility Act. **Response—**The Service has determined and the Office of Management and Budget has concurred that these are not required for listing actions that do not involve

critical habitat. The Endangered Species Act requires that listing determinations be based solely on biological information.

Issue 26: The Alabama Forestry Commission stated that if best management practices are followed and streamside management zones are set aside, forestry related activities should not adversely affect the turtle's stream habitat. The Commission also recommended an educational program regarding the flattened musk turtle. **Response—**The Service will work with the Commission to approach or achieve full compliance with the best forestry management practices in the Black Warrior Basin. The Service will include an educational program in the recovery plan for this species.

Issue 27: Why does the Alabama State law prohibiting taking not remove all threats or at least the taking threat and how is the Lacey Act enforced with regard to the taking of flattened musk turtles? **Response—**The Service has information that commercial collecting is continuing. A serious decline in Sipsey Fork documented by Dodd *et al.* (1986) was suggested by one commenter to have resulted from commercial turtle collecting. Enforcement of taking prohibitions is extremely difficult. One commenter pointed out, and the Service agrees, that additional protection and enforcement would be provided under the Endangered Species Act. Commenters also pointed out that the grandfather provision of the Alabama law, passed in 1984, makes the law extremely difficult to enforce and the Alabama law does not prohibit incidental take as the Federal Act does. The Lacey Act should also enhance the Alabama State law since it essentially makes it a Federal offense to engage in interstate commerce of State listed wildlife and plant species. The Lacey Act is enforced by Federal wildlife law enforcement personnel.

Issue 28: Stream classification in the Black Warrior River Basin should be updated. **Response—**The stream classifications have been checked with ADEM and so noted in the final rule. There have been several stream classification changes since 1978, but 13 streams (about 20 percent) continue to be classified in the two lowest use categories (for agricultural and industrial water supply or for industrial operations only), as indicated in the proposal.

Issue 29: The Review Panel report was criticized for using speculative phrases (i.e. reasonable to assume, could possibly, may affect, may cause, etc.). **Response—**The use of such terms in the biological sciences is standard. Most of

the panel's conclusions were based on data from the studies, however, where only empirical evidence is available, the consensus of qualified experts is valuable. A specific example of speculation that was criticized had to do with whether or not proof is available that toxic material has been introduced into the sediment and the flattened musk turtle's food sources. Neither the Service nor the panel claimed that this has been proved. On the basis of studies in other watersheds and on other aquatic organisms, the accumulation of toxins was appropriately mentioned as a possible concern.

Issue 30: A recommendation was made that the proposed rule be withdrawn and 3-5 years of additional study be undertaken. **Response—**The Service has concluded that listing is appropriate based on the best available biological and commercial data. The panel's conclusions support this conclusion. Three major studies have been carried out on this species, more than on most other listed species. The Service has been actively and formally gathering information on the flattened musk turtle for 10 years, since its first notice of review for the species in 1977. Two additional years of data gathering and evaluation were carried out after the Service was petitioned to list the species in 1983. The Service does not think additional study is necessary to reach the primary conclusion that the species is threatened. It does find listing to be appropriate at this time on the basis of existing biological data and the legal requirements of the Endangered Species Act.

Issue 31: A question was raised as to whether the panel considered Mount's 1981 report or the Alabama law, which offers some protection to the flattened musk turtle. **Response—**The panel considered all the available biological and commercial data, including the two documents in question. A 1987 paper by Ernst *et al.* was provided to the Service after the panel report had been completed and submitted. The Ernst *et al.* report was then circulated to all the panel members, who found nothing in the report that would cause them to change any of their conclusions.

Summary of Factors Affecting the Species

After a thorough review and consideration of all information available, the Service has determined that the flattened musk turtle should be classified as a threatened species. Procedures found at section 4(a)(1) of the Endangered Species Act (16 U.S.C. 1531 *et seq.*) and regulations (50 CFR

Part 424) promulgated to implement the listing provisions of the Act were followed. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in Section 4(a)(1). These factors and their application to the flattened musk turtle (*Sternotherus depressus*) are as follows:

A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

The flattened musk turtle historically occurred in the Black Warrior drainage upstream from the fall line. The Service is listing the population of *S. depressus* in the Black Warrior River basin upstream from Bankhead Dam, which is considered to be unaffected by hybridization with *S. minor peltifer* (see discussion in Background section). Impoundments and habitat degradation between Bankhead Dam and the fall line are thought to have possibly contributed to the effective elimination of the flattened musk turtle from this lower portion of its range. Habitat of the flattened musk turtle in the Black Warrior basin upstream from Bankhead Dam has also been reduced or degraded due to agricultural, residential, and industrial development and siltation and water pollution.

Siltation appears to be a primary factor affecting the habitat of the flattened musk turtle. Possible adverse effects of silt include: "(1) The extirpation or reduction in populations of mollusks and other invertebrates on which the turtles feed, (2) physical alteration of the rocky habitats where the turtles seek food and cover, and (3) development of a substrate in which chemicals that may be toxic to the turtles or their food sources tend to accumulate and persist. Dodd *et al.* (1986) concluded after an intensive study that siltation appears to have seriously impacted the flattened musk turtle.

Activities and sources that have historically and may currently be contributing to the siltation problem include agriculture, forestry, mining, and industrial and residential development. Before passage of laws regulating the amounts of silt that these activities can contribute to streams the Black Warrior River Basin was being impacted heavily. The entire upper Basin is underlain by the Black Warrior and Plateau Coal Fields, and forestry and agriculture are common land uses throughout the Basin. Before implementation of the stricter regulations about 69 percent of the annual sediment yield was attributed to accelerated erosion from such sources (USDA 1980). Annual erosion in 1975

was estimated at 5.5 million tons from cropland and pastureland (sheet and rill); 4.1 million tons from commercial forest land; 7.9 million tons from gulleys, roadsides, and streambanks; and 9.1 million tons from mined lands (USDA 1980).

The Soil Conservation Service's projections for amounts and rates of sedimentation in the Black Warrior River Basin (USDA 1980) were discussed in the proposed rule to illustrate the magnitude of sedimentation possible. During the comment period it was pointed out that the USDA projections related to mining impacts were based on the 1975 Surface Mine Regulations, and that enforcement of new regulations may have reduced both the amount and rate of projected sedimentation. The projections have been removed and only the actual estimates for 1975 included in the final rule. Projections based on the newer regulations are not available. However, the streams in the Basin are still affected by past impacts, and considerable sedimentation is still occurring. Stream recovery and resulting improvement in the turtle's status are expected to be slow processes, and it may be some time before it can be determined if, and to what extent, these are occurring.

Chemical and organic pollution is another factor of water quality in the flattened musk turtle habitat that may affect its survival, although the correlation is less clear than with siltation. Mount (1981) postulated effects such as shell erosion and loss of invertebrate food organisms from this source. Some of Alabama's most severe water quality problems are located in this river basin, particularly in the Birmingham area. Of the streams in the Basin, 13 (about 20 percent) are classified only for agricultural and industrial use. The human population in the Black Warrior Basin is projected to increase 33 percent between 1975 and 2020 (USDA 1980), which may aggravate existing water quality problems. The most pervasive class of environmental contaminants found in aquatic ecosystems originates from non-point sources such as agriculture, energy-related activities, surface mining, and urban development (U.S. Fish and Wildlife Service 1983). Mine drainage effects have been described for other states by Matter *et al.* (1978) and Vaughan *et al.* (1978) and were summarized in the proposed rule. They indicate that contour mining for coal can profoundly affect population sizes, species richness, and equitability of various groups of organisms, but that

streams can return to a "healthy" condition over a period of perhaps 20 years. Five other studies (Geological Survey of Alabama 1983, Cole 1985, Harris *et al.* 1985, Puente and Newton 1979, and Puente *et al.* 1982) describe local effects of surface mining on water quality as well as sedimentation. They indicate that concentrations of dissolved solids, calcium, magnesium, sulfate, aluminum, iron, manganese, noncarbonate hardness, alkalinity, and specific conductance are often much greater at mined sites than in streams draining unmined areas.

As indicated in the comment section, the Office of Surface Mining and its Alabama counterparts have made progress in enforcing the new, more stringent mining regulations. Active complying mines are probably not a major factor in the decline of the flattened musk turtle. Past mining practices, non-complying mines, and abandoned mines may still be contributing sediment and chemical pollution to the streams, and the Service will work with the regulatory agencies to address these problems during the recovery process. The Service does not anticipate that this listing will result in the imposition of new permit conditions on mines that comply with current regulatory programs or future regulatory programs that are as stringent as current programs.

Finally, hydrologic changes associated with mining, including declines in water level, spoil aquifer creation, and changes in streamflow characteristics, and various navigation and flood control projects may have adverse effects on the habitat of the flattened musk turtle, but the magnitude of such effects remains unknown. The existing navigation channel on the Black Warrior River covers approximately 88 river miles, and there are potential projects on the tributaries Valley Creek and Village Creek (U.S. Army Corps of Engineers 1982, 1984). The Soil Conservation Service has completed one project at Bristow's Creek and authorized one for construction at Mud Creek in the upper Black Warrior River Basin (USDA 1984). Such projects appear to have both potential benefits and threats for the flattened musk turtle.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The flattened musk turtle has been listed for sale on several dealer price lists at prices above \$80 each. Documented collections have included 200 individuals from one stream, 169 individuals from two streams, 136 turtles

from a four-mile stretch of one stream, and 20 to 30 specimens from a single pool at one time. Most of the formerly good populations have been considerably reduced through collecting in recent years. The Dodd study documented a serious decline during its course in one of the best remaining populations (Sipsey Fork), attributed provisionally to an observed, unidentified disease, but possibly caused or exacerbated by illegal taking. Because this turtle inhabits clean, shallow water, it is more visible and therefore highly vulnerable to collecting. One or a few knowledgeable collectors can seriously reduce a local population in a short period of time. Persistent collecting in other chelonian populations reduces the intrinsic rate of increase of the population by removing breeding adults even though chelonians are long-lived and may exist in dense populations. Collecting of younger age cohorts will exacerbate the problem. In those few studies available, the effects of collecting are not observable for several generations. Uncontrolled collecting has resulted in extinction while even controlled and monitored collecting can result in a decline in the population. Collecting that permanently removes individuals from a population represents additional 'mortality' to the population which must be offset with higher than normal recruitment in order to maintain stable populations; however recruitment appears low in flattened musk turtles.

C. Disease or Predation

Estridge (1970) found three out of seven specimens parasitized by a protozoan agent of turtle malaria. Ernst *et al.* (1983) found some specimens heavily parasitized by a leech that carries the protozoan. Mount (1981) hypothesized that flattened musk turtles are susceptible to shell erosion and infections, especially as a secondary effect of water pollution. A disease has been noted in populations of the flattened musk turtle. Almost one-fourth of the turtles caught by Dodd *et al.* (1986) in the last trap sample at one site were diseased; and more than one-half of all turtles of this species observed basking in the Dodd study were considered sick. The Sipsey Fork population was found to decline by 50% from the end of June through late July 1985; additional study in 1986 found no additional decline (Dodd 1986). Assessing the impact of the disease has been hampered by over-collecting. It is still difficult to assess the effect of the disease, if any, on the populations at this juncture.

D. The Inadequacy of Existing Regulatory Mechanisms

Legislation enacted by the Alabama legislature (May 21, 1984) prohibits the taking of flattened musk turtles. However, such laws prohibiting over-exploitation are extremely difficult to enforce. The Alabama law has a grandfather clause that causes particular enforcement problems and it does not prohibit incidental take as the Federal Act does. According to Guthrie (1986), commercial collecting is continuing. Protection under the Endangered Species Act will provide additional protection and reinforce Alabama's law.

E. Other Natural or Manmade Factors Affecting Its Continued Existence

Several biological characteristics of the flattened musk turtle increase its vulnerability to the threats discussed previously. This turtle does not mature sexually until 4-8 years of age, and normally deposits only two clutches of eggs per year with one to three eggs per clutch (Close 1982). This low reproductive rate reduces the ability of the species to recover rapidly from adverse habitat changes or to respond rapidly to conservation activities. Since the flattened musk turtle occurs only in the upper Black Warrior River Basin, it evidently has rather specific habitat requirements. This factor increases the likelihood of adverse impact from habitat modifications. Flattened musk turtles feed primarily on mollusks (Marion *et al.* 1986), which are particularly susceptible to siltation and water pollution. The turtles also feed and spend virtually all of their time at the stream bottom and thus are in almost constant contact with any toxic bottom sediments that may be present. Dodd *et al.* (1986) also pointed out that habitat fragmentation, which has already occurred and is expected to continue, is also a serious problem for the flattened musk turtle. The curtailment of the range of *S. depressus* because of hybridization was discussed above.

The Service has carefully assessed the best scientific and commercial information available regarding the past, present, and future threats faced by this species in determining to make this rule final. Based on this evaluation, the preferred action is to list the flattened musk turtle in the Black Warrior Basin upstream from Bankhead Dam as threatened. While progress has been made in improving mining and water quality regulations and the State of Alabama has passed a law to restrict collection of the flattened musk turtle,

the species remains vulnerable. The cumulative impact of all past and current activities and projected increases in some activities are still sources of concern. Stream recovery, if it is occurring, is a slow process and may not be clearly discernible for years. Over-collecting is a serious problem that compounds any losses from habitat degradation. The flattened musk turtle appears likely to become in danger of extinction within the foreseeable future throughout all or a significant portion of its range. Critical habitat is not being designated, for reasons discussed in the next section.

Critical Habitat

Section 4(a)(3) of the Act, as amended, requires that to the maximum extent prudent and determinable, the Secretary designate critical habitat at the time a species is determined to be endangered or threatened. The Service finds that designation of critical habitat is not prudent for this species at this time. As discussed under Factor "B" in the above "Summary of Factors Affecting the Species," the flattened musk turtle is threatened by taking, an activity difficult to detect and prohibit. Publication of critical habitat descriptions would make this species even more vulnerable and increase enforcement problems. Therefore, it would not be prudent to determine critical habitat for the flattened musk turtle at this time.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Endangered Species Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing encourages and results in conservation actions by Federal, State, and private agencies, groups, and individuals. The Endangered Species Act provides for possible land acquisition and cooperation with the States and requires that recovery actions be carried out for all listed species.

Some of the recovery actions that may be initiated by the Service following listing are as follows: (1) Convene a work group of all involved parties including SCS, EPA, BLM, OSM, U.S. Forest Service (USFS), ASMC, and ADEM, to assist the Service in initiating and coordinating recovery efforts. (2) Increase law enforcement efforts with regard to commercial collecting of flattened musk turtles through section 9 of the Endangered Species Act and the

Alabama State law. (3) Conduct additional studies and seek remedies for the disease and recruitment problems that have been identified in flattened musk turtle populations. (4) Initiate information and education efforts with private landowners and the general public to increase awareness of recovery efforts needed for the flattened musk turtle.

Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is being designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR Part 402. Section 7(a)(2) requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Service.

Federal activities that could either positively or adversely affect the flattened musk turtle and its stream habitats in the Black Warrior River Basin upstream from Bankhead Dam include: U.S. Forest Service activities such as clear cutting, road building, land exchanges, and chemical application that could discharge silt and chemicals into the Black Warrior River system; mineral leases issued by the BLM; projects by the Federal Highway Administration that could discharge silt and chemicals into the Black Warrior River system; certain U.S. Army Corps of Engineers' projects and permits, such as dredging and spoil dispersal, that could alter flattened musk turtle habitat; projects funded by the U.S. Department of Agriculture through the Agricultural Stabilization and Conservation Service and SCS; mining regulations under the Federal authority of OSM; and effluent limitations under the Federal authority of the Environmental Protection Agency. The Service will work cooperatively with all these agencies to insure the turtle's continued existence and accommodation of the listed activities to the maximum extent possible.

As discussed in the comment section (Issue 19) a section 7 no jeopardy opinion has been issued to OSM on the State of Alabama's mining program. The Service does not foresee any need for changes to that opinion, the current OSM regulations, or the existing procedures for individual mining permit

review. Currently individual mining permits are informally reviewed by the Service to provide advice and technical assistance as established in the existing Memorandum of Understanding between the Service and OSM. The listing of the flattened musk turtle will not require any additional reviews beyond those currently established. The Service will continue to work cooperatively with OSM to minimize any impacts on listed species including the flattened musk turtle, while continuing to accommodate compliant mining. Similarly, the Alabama Forestry Commission has indicated that forest management activities conducted according to "best management practices" have negligible impact on soil erosion rates and stream sedimentation. If "best management practices" are followed and streamside management zones are set aside to protect water quality as indicated, forestry-related activities should not adversely affect stream habitats. The Service will continue to work with the USFS to minimize any impact on listed species including the flattened musk turtle, while continuing to accommodate forestry-related activities.

The Act and implementing regulations found at 50 CFR 17.21 and 17.31 set forth a series of general prohibitions and exceptions that apply to all threatened wildlife. These prohibitions, in part, make it illegal for any person subject to the jurisdiction of the United States to take, import or export, ship in interstate commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. It also is illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies.

Permits may be issued to carry out otherwise prohibited activities involving threatened wildlife species under certain circumstances. Regulations governing permits are at 50 CFR 17.22, 17.23, and 17.32. Such permits are available for scientific purposes, to enhance the propagation or survival of the species, and/or for incidental take in connection with otherwise lawful activities. For threatened species, there are also permits for zoological exhibition, educational purposes, or special purposes consistent with the purposes of the Act. In some instances, permits may be issued during a specified period of time to relieve undue economic hardship that would be suffered if such relief were not available.

The Service will review this species to determine whether it should be considered for placement on the appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora and on the Annex of the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere.

National Environmental Policy Act

The Fish and Wildlife Service has determined that an Environmental Assessment, as defined by the National Environmental Policy Act of 1969, need not be prepared in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act of 1973, as amended. A notice outlining the Service's reasons for this determination was published in the *Federal Register* on October 25, 1983 (48 FR 49244).

References Cited

- Close, D.K. 1982. The reproductive cycle of *Sternotherus minor depressus*. Unpubl. M.S. thesis, Univ. of Alabama, Birmingham, Alabama. 101 pp.
- Cole, E.F. 1985. Effects of coal mining on the water quality and sedimentation of Lake Tuscaloosa and selected tributaries, North River Basin, Alabama. U.S. Geological Survey Water-Resources Investigations Report 84-4310. 53 pp.
- Dodd, C.K. Jr., K.M. Enge, and J.N. Stuart. 1986. The effects of mining siltation on the distribution and abundance of the flattened musk turtle, *Sternotherus depressus*, in northern Alabama. Unpublished Report to fulfill Interagency Agreement No. J5140132 between OSM and USFWS. 82 pp. + Appendices, Figures, and Tables.
- Ernst, C.H., and R.W. Barbour. 1972. Turtles of the United States. Univ. Press of Kentucky, Lexington. x + 347 pp.
- Ernst, C.H., W.A. Cox, and K.R. Marion. 1983. The distribution and status of the flattened musk turtle in the Warrior Basin of Alabama. Unpublished Report to Alabama Coal Association. iii + 136 pp.
- Ernst, C.H., K.R. Marion, W.A. Cox, and J.L. Miller. 1987. Comparisons of shell morphology among turtles of the *Sternotherus minor* complex. Draft manuscript submitted for publication. 18 pp.
- Estridge, R.F. 1970. The taxonomic status of *Sternotherus depressus* (Testudinata, Kinosternidae) with observations on its ecology. M.S. thesis, Auburn Univ., Auburn, Alabama. 49 pp.

- Geological Survey of Alabama. 1983. Biological and hydrological impacts of surface mining for Federal minerals on the Tyro Creek watershed, Alabama. Phase I. Premining—Aquatic Baseline Information. Univ. of Alabama. 98 pp.
- Guthrie, R.W. 1986. Derivation of a habitat quality predicting function for the flattened musk turtle. Unpublished report submitted as comments on the proposal by the Birmingham Field Office of OSM. 32 pp. + maps.
- Harris, S.C., P.E. O'Neil, M.F. Mettee, and R.V. Chandler. 1985. Impacts of surface mining on the biology and hydrology of a small watershed in west-central Alabama. Geological Survey of Alabama Bulletin 125 on fulfillment of BLM Contract No. AA851-CT1-49. 124 pp.
- Hubbard, P., T. Strong, R. Darby, and R. Tew. 1983. The flattened musk turtle (*Sternotherus minor depressus*). Unpublished Report by employees of Drummond Coal Company. 22 pp.
- Iverson, J.B. 1977a. *Sternotherus depressus*. Catalogue of American Amphibians and Reptiles. 194.1-194.2.
- Iverson, J.B. 1977b. Geographic variation in the musk turtle, *Sternotherus minor*. Copeia 1977:502-517.
- Marion, K.R., F.M. Love, W.A. Cox, and C.H. Ernst. 1986. Abstract—Food habits of the flattened musk turtle (*Sternotherus depressus*). ASB Bulletin. 33(2):62.
- Matter, W.J., J.J. Ney, and O.E. Maughan. 1978. Sustained impact of abandoned surface mines on fish and benthic invertebrate populations in headwater streams of southwestern Virginia, pp. 203-216. In D.E. Samuel, J.R. Stauffer, C.H. Hocutt, and W.T. Mason, Jr., eds. Surface mining and fish/wildlife needs in the eastern United States, Proceedings of a Symposium. U.S. Fish and Wildlife Service. 511 pp.
- Mount, R.H. 1978. Amphibians and reptiles, pp 67-79. In H. Boschung, ed. Endangered and threatened plants and animals of Alabama. Bulletin, Alabama Museum of Natural History, Univ. of Alabama. 93 pp.
- Mount, R.H. 1981. The status of the flattened musk turtle, *Sternotherus minor depressus*, Tinkle and Webb. Unpublished Report to U.S. Fish and Wildlife Service, Atlanta, Georgia. v + 119 pp.
- Mount, R.H. 1986. Flattened musk turtle (*Sternotherus minor depressus*, Tinkle and Webb). p. 40-41. In: Mount, R.H. ed. Vertebrate Animals of Alabama in Need of Special Attention. Alabama Ag. Exp. Station, Auburn Univ. 124 pp.
- Puente, C., and J.G. Newton. 1979. Effect of surface coal mining on the hydrology of Crooked and Turkey Creek Basins, Jefferson County, Alabama. U.S. Geological Survey Water-Resources Investigations Report 79-91. 39 pp.
- Puente, C., J.G. Newton, and R.H. Bingham. 1982. Assessment of hydrologic conditions in potential coal-lease tracts in the Warrior Coal Field, Alabama. U.S. Geological Survey Water-Resources Investigations Open-File Report 81-540. 42 pp.
- Seidel, M.E., and R.V. Lucchino. 1981. Allozymic and morphological variation among the musk turtles *Sternotherus carinatus*, *S. depressus*, and *S. minor* (Kinosternidae). Copeia 1981:119-128.
- Tinkle, D.W. 1958. The systematics and ecology of the *Sternotherus carinatus* complex (Testudinata, Chelydridae). Tulane Studies in Zoology. 6:1-56.
- Tinkle, D.W. 1959. The relation of the fall line to the distribution and abundance of turtles. Copeia 1959:167-170.
- Tinkle, D.W., and R.G. Webb. 1955. A new species of *Sternotherus* with a discussion of the *Sternotherus carinatus* complex (Chelonia, Kinosternidae). Tulane Studies in Zoology. 3:52-67.
- U.S. Department of Agriculture. 1980. Black Warrior River Basin Cooperative Study. 217 pp.
- U.S. Department of Agriculture. 1984. Soil Conservation Service Watershed Progress Report—Alabama. iii + 45 pp. + map.
- U.S. Army Corps of Engineers. 1982. Mobile District Project Maps.
- U.S. Army Corps of Engineers. 1984. Mobile District Corps of Engineers Projects in Alabama. Unpaginated data sheets.
- U.S. Fish and Wildlife Service. 1983. Ecological indicators of contaminant stress, p. 35. In P.H. Eschmeyer and T.A. Scott, eds. Fisheries and wildlife research, 1982. 199 pp.
- Vaughan, G.L., A. Talak, and R.J. Anderson. 1978. The chronology and character of recovery of aquatic communities from the effects of strip mining for coal in east Tennessee, pp. 119-125. In D.E. Samuel, J.R. Stauffer, C.H. Hocutt, and W.T. Mason, Jr., eds. Surface mining and fish/wildlife needs in the eastern United States, Proceedings of a Symposium. U.S. Fish and Wildlife Service. 511 pp.
- Wermuth, H. and R. Mertens. 1961. Schildkroten, Krokodile, Bruckeneschen. VEB Gustav Fischer Verlag, Jena, Germany. xxvi + 422 pp.

A more complete list of references and associated documents not referenced here is available for inspection along with the remainder of the administrative record as indicated under the **ADDRESSES** section in this document.

Author

The primary author of this final rule is Mr. John J. Pulliam, III (see **ADDRESSES** section) at 601/965-4900, FTS 490-4900.

List of Subjects in 50 CFR Part 17

Endangered and threatened wildlife, Fish, Marine mammals, Plants (agriculture).

Regulation Promulgation

PART 17—[AMENDED]

Accordingly, Part 17, Subchapter B of Chapter I, Title 50 of the Code of Federal Regulations, is amended as set forth below:

1. The authority citation for Part 17 continues to read as follows:

Authority: Pub. L. 93-205, 87 Stat. 884; Pub. L. 94-359, 90 Stat. 911; Pub. L. 95-632, 92 Stat. 3751; Pub. L. 96-159, 93 Stat. 1225; Pub. L. 97-304, 96 Stat. 1411 (16 U.S.C. 1531 *et seq.*).

2. Amend § 17.11(h) by adding the following, in alphabetical order under "Reptiles," to the List of Endangered and Threatened Wildlife:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
REPTILES							
Turtle, flattened musk	<i>Stemotherus depressus</i>	U.S.A. (AL)	Black Warrior River system upstream from Bankhead Dam.	T	272	NA	NA

Dated: June 4, 1987.

Susan Recce,

Acting Assistant Secretary for Fish and Wildlife and Parks.

[FR Doc. 87-13243 Filed 6-10-87; 8:45 am]

BILLING CODE 4310-55-M